

Literature Review

The world has changed. Students have changed. And yet, for the most part, teaching and learning in Canadian schools is not reflective of this change. Most students in our schools today are receiving the same education, delivered in the same way, as in their parents', or even their grandparents' day. According to Gilbert (2005)

Most contemporary schools are...perversely designed so that nobody gets to work very long in her regime of competence. If anyone gets remotely competent at one topic, clearly it is time for him or her to move on to the next. The external controls of teachers, curriculum, and grades work against much activity in the regime of competence for most students. (p. 85)

Gilbert goes on to state that "Knowing, learning, and doing things with knowledge...have superseded the amassing of factual information and recalling it upon demand that was the hallmark of a good education in the 20th century" (p. 76). Further, she emphasizes the importance of teaching students how to work with others to generate new knowledge. Gilbert states that "our current model of education is designed to reproduce existing knowledge and existing social structures...by sorting people" and explains that cognitive scientists see ability as a highly malleable capacity to think and learn (p. 80). She postulates that "education's purpose is to *develop* ability, not to sort people according to whether or not they already have it" (p.80).

Engaging 21st century learners requires a close look at what it means to teach and learn in increasingly networked, technology-rich, digital classrooms. Teachers must be able to develop responsive pedagogies that are effective for a knowledge era, and thoughtfully and intentionally design learning environments and tasks in which students can explore issues that are relevant. They need to develop new images and acquire new expertise to design and facilitate meaningful learning with technology. Given this shift in our world, and the new research from the Learning Sciences, one can see the complexity that teachers face in

engaging learners in the 21st century. This literature review will examine the current research findings about teaching and learning in light of these changed and changing conditions.

Engaged in Learning

The Canadian Education Association (CEA) (2009), has prepared a summary of findings from the first year of their “What Did You Do in School Today?” research initiative in which they highlight the importance of engaging students, not only due to the impact on future possibilities and career choices, but in recognition of the impact it has on the quality of their school experiences and their lives in the immediate present.

They remind us:

... young people are not just adults-in-training; their lives as they experience them now are as valuable and meaningful as those of the adults they will become. How they feel about school and how “well” they do is, for most young people, central to their daily lives—whether they feel good about themselves and cared for at school; whether they are frustrated, anxious, bored, or depressed; whether they feel vibrant and excited by what they are learning; and, for that matter, whether they are learning at all. (p. 6)

Looking more deeply into the research literature on student engagement, it becomes clear that effective teachers present learning opportunities that are thoughtfully and intentionally designed to engage students both academically *and* intellectually. As Schlechty (2002) states, “...the key to school success is to be found in identifying or creating engaging schoolwork for students” (p. xiv). But what do we mean when we speak about academic and intellectual engagement? How do these terms differ? Friesen (2007) provides these guideposts:

Academic engagement is identified by on-task behaviours that signal a serious engagement in class work; these include attentiveness, doing the assigned work, and showing enthusiasm for this work by taking initiative to raise questions, contribute to group activities and help peers.

Intellectual engagement refers to an absorbing, creatively energizing focus requiring contemplation, interpretation, understanding, meaning-making and critique which results in a deep, personal commitment to explore and investigate an idea, issue, problem or question for a sustained period of time.

According to the CEA (2009) findings, intellectual engagement is more likely to occur when learning environments are carefully designed to reflect these characteristics:

- effective use of learning time
- positive teacher/student relations and disciplinary climates
- high expectations for success
- appropriate instructional challenge.

Friesen (2007) created the rubric below, showing the interplay between academic and intellectual engagement and the design of the tasks that students are asked to undertake.

Teachers must intentionally take on the role of designers of learning with the aim of creating work that will foster authentic intellectual learning. As Friesen illustrates through this rubric, the work, inquiries, or tasks must be thoughtfully designed in such a way that academic rigor, authenticity, assessment for and of learning, active exploration, use of technology, and providing opportunities for metacognition are all considered.

	Intellectual Engagement	Academic Engagement
Academic Rigor	The work that the students do has meaning to the students, to the discipline and to the world. That meaning is connected to ends or results that truly matter. Students can see and articulate the connections. Students understand that they are integral to creating the work that results in insight about themselves, i.e. they feel and know that knowledge creation is a human endeavour; knowledge lives.	The work that the students are asked to do is challenging but disconnected from the larger picture. Students do the work and carry out the tasks, sometimes with diligence and persistence, but they do so for reasons that are dissociated from the work itself. (i.e. to go to university, to get good grades, etc.). Students know that their task is to learn the material, remember it and recite it back.

	Knowledge is alive, dynamic, created by people. Here it is ecological.	Knowledge is fixed, static, consumer oriented. Here it is a commodity exchange.
Authenticity	The work that the students are asked to do emanates from a question, problem or exploration that has meaning to the students and is deeply connected to the living character of the academic discipline.	The scope of the work that students are asked to do is determined mainly by the curriculum.
	The work that students are asked to do originates with an issue, problem, question, exploration or topic that provides opportunities to create or produce something that has impact beyond the classroom.	The work that the students are asked to do originates with and meets or even exceeds the program of studies expectations.
Assessment	On-going assessment is woven into the design of the work students do so they are provided timely descriptive on an ongoing basis.	Assessment is primarily summative and used to determine student's grades.
Technology	Technology is used in a purposeful manner that demonstrates an appreciation of new ways of thinking and doing. The technology is essential in accomplishing the work. It is used at every step of the design process, where it is needed, rather than as primarily presentational or for information gathering.	Technology is used for the sake of using technology, not because it will enhance or extend the work that the student is asked to do. The technology is not actually needed to accomplish the work, that is, the work could be completed without technology.
Active Exploration	The work that students do requires that they spend significant amounts of time doing field work, labs, interviews, studio work, construction, etc.	The work that students do can be completed in limited amount of time, in a few areas, and is paper and pencil oriented.
Metacognition	The work that students are asked to do provides opportunities for students to reflect on their learning using clear criteria that they helped to set. The students use this feedback to set learning goals, establish next steps and develop effective learning strategies.	Students set learning goals based on test scores.
	The work that students do requires that they search for, perceive and articulate patterns.	The work that students do does not require that they understand the conceptual connects that would allow them to talk across problems, disciplines, etc.

Newmann's (2000) research at the Center on Organization and Restructuring of Schools resulted in the articulation of three general characteristics of authentic intellectual work that include a) construction or generation of new knowledge; b) disciplined inquiry; and c) value beyond school. All three of these characteristics must be present; it is not enough to refer only to the "real world" dimension. Rather, Newmann suggests, "If intellectual work is to be authentic, it must be based on rigorous thinking and grounded in the substantive knowledge of the disciplines in addition to being 'relevant' to students' lives" (p. 2).

Bransford, J.D., Brown, A.L., & Cocking, R.R. (2000) remind us that if we are serious about engaging students in learning, the model of the child as an empty vessel just waiting to be filled with knowledge must be replaced. Teachers must actively inquire into students' thinking and create classroom tasks and conditions under which students' thinking can be revealed. Bransford et al. (2000) define metacognition as "... people's abilities to predict their performances on various tasks and to monitor their current levels of mastery and understanding" (p.12). In undertaking the design of authentic intellectual learning, teachers must carefully consider and structure opportunities throughout any given task for students to monitor their own understanding and make decisions about what to do when it is not adequate. Effective teachers know that most students have a limited perspective and even a distorted view of their own potential and capabilities (Dweck, 2006). As designers of learning, teachers must help students move in directions they might initially want to avoid and encourage students to take risks, to test their learning and thinking in situations and contexts in which they may feel uncomfortable and uncertain (Schlechty, 2002). However, Schlechty also suggests, "...when students are authentically engaged, the distinction between ends and means becomes blurred. What in another context they would consider trivial and meaningless becomes loaded with meaning and significance to those who are authentically engaged" (p. 10).

Wiggins and McTighe (2007) state, "Successful learning means that each learner is helped to see new meaning and to become more accomplished; successful instruction

translates content into tools and experiences needed to achieve this” (p. 114). Schlechty (2002) concurs, asserting that teachers’ energies need to be directed towards creating, designing, identifying, or otherwise making available to students authentically engaging activities, programs, tasks and assignments. Schwartz and Fischer (2003) stress the importance of providing *time* for students to engage in knowledge building, that is, to explore, build and make appropriate connections and conceptual relationships. Attempting to fast track this process or eliminate it completely, instead allowing students to ‘borrow’ relationships from their teachers rather than ‘building’ their own conceptual understanding, only leads to “rigid and inadequate skills”, according to Schwartz and Fischer (2003, p. 27). This means that as teachers design work for students, they must include discussions about what students believe and why they believe it, in order to unearth misconceptions early and provide experiences and time to enable students to move beyond those early understandings and construct a deeper understanding of the concept(s) under study.

According to Jenkins, Clinton, Purushotma, Robison, and Weigel (2006), society’s shift to a participatory culture requires an adeptness and facility with certain skills and literacies:

Literacy skills for the twenty-first century are skills that enable participation in the new communities emerging within a networked society. They enable students to exploit simulation tools, information appliances, and social networks; they facilitate the exchange of information between diverse communities and the ability to move easily across different media platforms and social networks. (p. 55)

However, Peck, Cuban and Kirkpatrick (2002) claim that in most classrooms, this is far from the case, and in fact, “teachers most frequently used technology to support, rather than alter, their existing teacher-centered practices” (p. 477). They found the use of technology in core academic subjects to be the exception and not the norm. It was not used in innovative ways and had limited impact on creating an engaging school learning experience.

This still rings true. Clifford, Friesen and Lock (2004) note that teachers must pay

attention explicitly and consistently to the relationship between technology and their own work as curriculum designers, and consider fundamental pedagogical connections from the outset; that what matters in relation to teaching and learning practices is how students and teachers are using technology and how that technology is used to foster the development of higher-order thinking skills. They note

...there is a world of difference between using digital environments that others have created, and learning how to build one, yourself. And it is here that critical and rhetorical literacies converge. Designing and building in digital environments provide rich opportunities to help students understand and critique the philosophical and ethical assumptions that are built into systems that just seem “natural” or “the way things are.”

That is, rhetorical literacy holds the possibility to turn unquestioned, or poorly understood consumption into more incisive, creative and socially responsible engagement. (p. 102)

Breuleux (2001) agrees, stating that the effective use of digital technologies of our time can “support more powerful, more complete experiences of collaborative knowledge building” (p. 3). He goes on to say this can be accomplished, “...if we integrate well-designed technologies in the context of meaningful, mindful inquiry projects, non-presentational pedagogies, access to resources and tools, and adequate support for technological maintenance and pedagogical renewal” (p. 3).

The idea of form determining function, or “functional fixedness”, contributes to the notion that technologies would be used in a particular way in education. In the case of information and communication technologies or ICTs, it is not always the actual form of the technology that is constraining its use but rather more likely the properties of the educational system, the curriculum, and the pedagogy that have been restraining any imaginative use in terms of teaching and learning. When the only implement you are accustomed to having is a hammer, everything appears to be a nail. Koehler and Mishra (2008) argue that we must work to innovate creative repurposing of digital technologies to meet the needs of 21st century learners rather

than using them to perpetuate traditional paradigms that have become irrelevant. Additionally, we need to consider that emerging technologies can and should be used in multiple ways for varied purposes.

The fact that new technologies are emerging at an unprecedented rate is our cue that we as educators and the children who are now our students will need the ability to apply themselves to problems , challenges and learning in a manner that is flexible, adaptable and innovative. Swain and Edyburn (2007) go as far to identify the issue of using of technology as a means of engaging students in learning as one of social justice, in that students who are not ...technologically fluent and able to use technology to solve problems with various sources of information, create new representations of their knowledge, and enhance their learning through diverse strategies afforded by technology...are at a decided disadvantage in terms of future educational and employment opportunities in our global, technological, and information-based society. (p. 15)

They point to the capacity of assistive technologies to 'erase the weakness' of students with special learning needs and open opportunities that may have been previously closed, creating a closer match between the learner and the learning environment. In his thought provoking article, "Failure is not an Option", Edyburn (2006) poses the evocative question: "How long do we allow students to fail at a given task before we provide them with appropriate performance support tools?" (p. 20) and discusses an apparent educational bias toward 'naked independence', in which a "performance that is completed without the aid of external devices and resources is prized over performance that is dependent on tools or resources" (p. 22), which of course, gives an advantage to able-bodied individuals over those who must rely on external devices. He challenges our notions of fairness (everyone gets the same thing) and posits, instead, that fairness actually means that everyone gets what they need. It is important to consider the implications of this statement in terms of our struggling students. As Rose and Meyer (2002) point out, if we are going to reach all students, then our students need to have

multiple routes to learning and knowledge building available to them. This means as teachers design learning environments, they must also consider the principles of Universal Design for Learning (which advocates universal access to learning) and include three fundamental characteristics: multiple means of representation; multiple means of expression; and multiple means of engagement.

Quite clearly, teaching itself has become an inquiry...a loose, ill-defined yet very complex space, something that Koehler and Mishra (2008) have labeled a “wicked problem” in the sense of having properties of being “incomplete, contradictory, and changing requirements” and “...complex interdependencies among a large number of contextually bound variables.” While this description certainly fits, the good news is that when a teacher begins to think about teaching a topic, s/he has complete control over the design of the tasks that are going to both bound and uncover the learning. Teachers can very intentionally design rich, generous, authentic opportunities that put students in the centre of a task in which generative, iterative thinking and knowledge building powers the learning and pulls them into a space of both playing with concepts and being played by them, luring them into what Mihály Csíkszentmihályi calls ‘the flow zone’, in which time and place fall away as they are absorbed into the work of learning.

Effective Teaching Practices Make a Difference

Donovan and Bransford (2005) outline three fundamental principals of learning that relate to teaching:

1. *Students come to the classroom with prior knowledge that must be addressed if teaching is to be effective.* When designing learning, teachers need to take into account the diversity, cultural and otherwise, present in their classes and address the preconceptions and misconceptions that students hold in order to successfully teach new concepts and build new knowledge. Otherwise, students revert to their prior beliefs and understandings as quickly as the new ones are presented and tested.

2. *Students need to organize and use knowledge conceptually if they are to apply it beyond the classroom.* Teachers who create work that is worthy of students' time and attention intentionally structure learning opportunities and inquiries in order to actively engage students in incorporating information, technology, critical thinking, increasingly complex problem solving, knowledge building and ongoing assessment that informs next steps in learning as well as in instruction.
3. *Students learn more effectively if they understand how they learn and how to manage their own learning.* A strong focus on assessment for learning that includes multiple feedback loops such as self-assessment, peer-assessment, teacher-assessment and feedback from experts helps scaffold the learning journey for students. Imbedding opportunities for reflectiveness into the learning process and teaching strategies for metacognitive practices as well as modeling and coaching students to provide clear, timely, effective feedback support them in becoming critical, empowered learners.

Linda Darling-Hammond (Powerful Learning, 2008) states highly effective teachers support these fundamental principles of learning by:

- Creating ambitious and meaningful tasks that reflect how knowledge is used in the field
- Engaging students in active learning, so that they apply and test what they know
- Drawing connections to students' prior knowledge and experiences
- Diagnosing student understanding in order to scaffold the learning process step by step
- Assessing student learning continuously and adapting teaching to student needs
- Providing clear standards, constant feedback, and opportunities for work
- Encouraging strategic and metacognitive thinking, so that students can learn to evaluate and guide their own thinking. (p. 5)

A review of current research literature revealed five core principles of effective teaching practice. First and foremost, effective teaching practice begins with the thoughtful and

intentional design of learning that engages students intellectually and academically. The second principle addresses the worthiness and nature of the work that students are asked to undertake, and suggests it needs to be relevant, meaningful, and authentic, in other words, worthy of their time and attention. A third core principle is the implementation of assessment practices that improve learning and guide further, responsive teaching. The fourth principle that emerged was the need for teachers to foster in their classrooms a variety of interdependent relationships that promote learning and create a strong culture around learning. Finally, the literature was clear that reflective, public teaching practice was another core principle – simply put, teachers improve their practice in community. Surrounding these five core principles and infused into each of them is the effective use of the technologies of our time for both teaching and learning, which is explored contextually throughout the literature review. These core principles have been expanded upon in the Teaching Effectiveness Framework published by the Canadian Educational Association (2008):

1. *Teachers are designers of learning.* This means that teachers must go beyond developing techniques to implement curriculum outcomes. Rather, teachers must deeply understand how to design learning environments that intellectually engage every student.
2. *Teachers design work for students that is worth their time and attention.* Work that is worthy of students' time and attention is personally meaningful to the student and deeply connected to the world in which they live.
3. *Teachers' use of assessment is directed towards improving student learning and guiding teaching decisions.* This means that teachers employ comprehensive assessment practices, with a strong emphasis on assessment for learning that is clearly focused on improving student learning and guiding teaching decisions and actions.
4. *Teachers build strong relationships with and between students through intellectually engaging work.* Attention is paid to promoting the kind of intellectual camaraderie and

dispositions towards learning that foster a mindset directed towards continuous learning and building community.

5. *Teachers are actively engaged in ongoing professional learning.* Teachers improve their practice in the company of peers and others who have a vested interest in improving teacher and student performance. Teachers understand that teaching is a scholarship, which improves through practice informed by research and evidence. (p. 8)

If what we know about teaching and learning has changed, and the programs of studies are being changed to incorporate skills and knowledge required for the 21st century learner, then the use of digital technologies in schools must facilitate and support these changes. In Bransford et al.'s (2000) review of learning research on what is known about using technology in learning, they conclude that the new technologies can be used to create learning environments "that extend the possibilities of the old technologies such as blackboards, books and television and also [to] provide new possibilities" (Ch. 9, p.1), but also that use of new technologies alone doesn't guarantee effective learning and that they can be used inappropriately (such as students spending time on the digital presentation rather than on the subject matter). Used effectively, technology's potential for interactivity can support the development of learning environments where students learn by doing, receive feedback, refine their understanding and build new knowledge, thus enabling the use of scaffolding tools which encourage more complex and deeper learning. New technologies can help with visualization of difficult concepts, and encourage use of simulations and modeling tools similar to those used in outside-school settings. They provide unprecedented access to a vast array of information and provide connection with discipline experts and real world contexts that can enable the development of global understanding as well as linking the school more directly with real world contexts.

Dexter, Anderson and Becker (1999) found that when teachers do adopt new technology, they don't report the technology as being the primary catalyst for the change; rather

they mentioned insight about teachers' own enhanced effectiveness obtained through reflection and professional development as the primary catalyst in assisting in the adoption of more constructivist approaches. This suggests the importance of sustained, collegial, job-embedded professional development. In line with the findings from other studies (Cox & Abbott, 2004; Sillanpää & Ilomäki, 2005), Becker (2001) concluded from a survey of over 4000 US teachers that compared to traditional transmission teachers, those with constructivist orientations used the computer in more ways that enhanced higher order thinking.

Roschelle, Pea, Hoadley, Gordin, & Means (2000), also concluded that "studies overwhelmingly suggest that computer-based technology is only one element in what must be a coordinated approach to improving curriculum, pedagogy, assessment, teacher development and other aspects of school structure" (p. 78). Parallel reforms that promote activities more in concert with what we know about learning (constructive, collaborative, contextualized, interactive) are more likely to support appropriate ICT use. They suggested that more contextual exploration of technology use in teaching and learning is essential:

The continuum of explorations stretches from basic research on learning with technology to applied research looking at the classroom practicalities of improving teaching when technology is a component. These should be executed with a reflective research component so that the knowledge gained can add to the rational basis used for making effective decisions. (p. 92)

In order for students to build the 21st century skills of critical thinking, oral communication, flexibility, self-direction, and teamwork, they must be given opportunities to develop them in the context of "complex, meaningful projects that require sustained engagement, collaboration, research, management of resources, and development of an ambitious performance or product" (p.12). Numerous research studies including Newmann, 1996, Bransford, Brown, and Cocking, 1999, and Bransford and Donovan, 2005 have demonstrated clearly that students learn more deeply and achieve better on complex tasks that

are actually set in authentic learning contexts. Authentic learning contexts are those that require the learner to engage in knowledge building, consider alternatives and multiple perspectives, and create and communicate work that reaches beyond the walls of the school.

It is important to note that authentic problems and real world projects do not in themselves guarantee learning; thoughtful planning, design and implementation are the key. For example, students could be highly engaged in building rockets without being able to demonstrate any development at all in learning about the principles of flight. However in a carefully designed inquiry, the teacher very intentionally connects the activity with the key concepts behind it. In this example, designing the task to require students to calculate the variables related to the distance the rocket would travel resulted in a huge increase in student understanding about flight principles (Petrosino, 1998, in Barron and Darling-Hammond, 2008).

In order to create the kind of student centred, well thought out and carefully designed work we are discussing, teachers need time, expertise, and a supportive community. It takes significant pedagogical sophistication to manage extended projects in classrooms that maintain a focus on “doing with understanding” rather than “doing for the sake of doing” (Barron et al., 1998). This supports the notion of teachers honing and improving their craft in the company of others, i.e. working in true professional learning communities.

Assessment Practices Guide Teaching and Improve Learning

Research in the field of assessment shows that effective teachers intentionally design into their pedagogical practice assessment that will assist students in thinking deeply about their own learning and that will provide a road map to their next steps. Incidentally, it is this very type of “assessment for learning” that also provides teachers themselves with their own next steps in teaching. Assessment explicitly designed to promote learning is a powerful tool for both raising standards and empowering lifelong learners. Marks, grades or comments on student work may tell them about their success or failure but not about how to make progress towards further

learning. Earl (2003) states that assessment ought to be an integral part of learning – guiding the process and stimulating further learning. In a 21st century learning environment, assessment should make up a large part of the school day, not in the form of separate tests, but as a seamless part of the learning process. The awareness of learning and ability of learners to direct it is of increasing importance in the context of encouraging lifelong learning (Assessment Reform Group, 2006).

William, Lee, Harrison, & Black (2004) give a succinct definition of the term 'assessment for learning':

Assessment for learning is an assessment for which the first priority in its design and practice is to serve the purpose of promoting pupils' learning. It thus differs from assessment designed primarily to serve the purposes of accountability, or of ranking, or of certifying competence. (p.2)

Goodrich (1999) of Harvard Education's *Project Zero* is one of many researchers to point out that students need clear targets and models of what constitutes quality work in order to improve achievement. He found that the use of instructional rubrics helps clarify teachers' expectations and instructional objectives, provides valuable feedback to students, and supports their learning, thinking, understanding, and the development of important skills, including self regulation (assuming this is part of an ongoing process of feedback). William et al. (2004) concur, stating that the criteria for evaluating any learning achievements must be made transparent to pupils to enable them to have a clear overview both of the aims of their work and of what it means to complete it successfully. Pupils can only achieve a learning goal if they understand that goal and can assess what they need to do to reach it. (Sadler, 1989, Stiggins, 2001, 2007). To put it more strongly, "If the student decides that the learning is beyond reach for her or him or that the risk of public failure is too great and too humiliating, then regardless of what we adults do, there will be no learning" (Stiggins, 2007, p. 42).

The Assessment Reform Group (2006) has identified 7 characteristics of assessment that

promote learning. These are: a) assessment is embedded in the design of the teaching and learning; b) students know the learning goals; c) students recognize the standards they are aiming for; d) pupils are involved in self-assessment; e) feedback provided enables students to take their next steps; f) teachers hold the belief that every student can improve; and g) assessment involves both teacher and pupils reviewing and reflecting on the assessment data. Black and Wiliam (1998) observed that as effective teachers work to improve learning through assessment they consider the following five factors:

- the provision of effective feedback to pupils;
- the active involvement of pupils in their own learning;
- adjusting teaching to take account of the results of assessment;
- a recognition of the profound influence assessment has on the motivation and self-esteem of pupils, both of which are crucial influences on learning;
- the need for pupils to be able to assess themselves and understand how to improve.

(pp. 4-5)

Wiliam et al. (2004) further state that effective teachers deliberately and directly teach the habits and skills of collaboration in peer-assessment, for peer discussion can help self-assessment by helping pupils to see their own work more objectively – through the eyes of their peers. In order for students to guide their own work and to become more self-regulated learners, effective teachers encourage them to keep in mind the aims of their work and to assess their own progress to meet these aims as they proceed through the assessment framework that has been designed.

Specific, descriptive feedback is an element of assessment that effective teachers use to improve learning, and they ensure that their students get this type of feedback in multiple ways from multiple sources including self-assessment, peer assessment, their teacher, and other sources such as parents and experts. However, in most classrooms, according to Stiggins

(2007), "Feedback provided to students remains evaluative (grades) versus helpfully descriptive. Students are rarely involved in self-assessment, tracking their own progress, or communicating their learning to others, all of which give rise to profound learning gains" (p. 46). This finding is corroborated in the Council of Ministers of Education (2005) *OECD Study on Enhancing Learning through Formative Assessment and the Expansion of Teaching Repertoires: Canadian Report*, which indicates that the use of assessment for learning is not widespread and that teachers are more likely to adhere to summative assessment practices. For teachers to implement new assessment strategies that facilitate formative assessment, they have to be provided with direction and develop skills on how to effectively use formative assessment in their classrooms.

Sadler (1998) stated that good feedback is at the heart of good pedagogy, and William, Lee, Harrison, & Black (2004) further explicate this by stating that in order to be effective, feedback provided to students in service of assessment for learning must cause thinking to take place. They contend it is the nature and quality of the feedback, rather than the amount, that is critical when giving pupils feedback on both oral and written work. Earl (2003) notes that a more student-centred approach to assessment results in students who are more self-regulated in their learning. Students who receive specific, descriptive feedback begin to think critically about their learning performance and can use the feedback from self-monitoring and the feedback they receive in other ways to "...make adjustments, adaptations and even major changes in what they understand" (p. 25). This assumes, of course, that the teacher has intentionally designed places and spaces for multiple feedback loops to support this metacognitive process early in the planning stages of the work.

Effective teachers use assessment for learning to support the development of self-regulated students but also to guide the next stages of learning; thus informing their teaching practice. According to Earl (2003), assessment for learning helps teachers to identify, uncover and lift students' current understandings and misunderstandings to higher level concepts and

skills, resulting in deeper understanding. Assessment for learning gives the reflective practitioner a window into which new directions, strategies and approaches might be most helpful to consider in guiding her next steps. *The Essential Learnings Assessing Guide*, Department of Education, Tasmania (2006), emphasizes the importance of teachers and students reflecting together on how understanding is developing during a study or inquiry, and using what has been learned in planning next learning steps. The teaching of metacognitive activities must be incorporated into the subject matter that students are learning (White and Frederickson, 1998 in Bransford et al., 2000). These are not generic metacognitive strategies that can be applied across all disciplines but are subject-specific, and Bransford et al. (2000) note that to teach them generically can lead to failure to transfer.

Sharing Leadership to Build Capacity

Distributed leadership among a group or network of interacting individuals has great potential to create a shift in the learning culture of a school, organization, or system. When people pool their expertise, energy and ideas, the outcome is always greater than anything they could have achieved individually. This is supported by multiple studies on leadership including Wilkinson, 2007; Gronn, 2002; Spillane, 2003; Bennett, Wise, Woods & Harvey 2003; Arrowsmith, 2006; and Court, 2003. Gronn's analysis indicated the importance of distributed expertise; in fact, no one person can be an expert on everything, and leadership in this sense, does not reside in one person. Instead, the key functions of an organization are performed by a group of specialists with collaborative and reciprocal relationships (Gronn, 2000 in Wilkinson, 2007).

Spillane, Diamond & Jita (2003) have developed three definitions or different ways to think about distributed leadership: collaborative distribution, collective distribution, and coordinated distribution. Each of these scenarios, or various combinations of them, may be appropriate in different situations:

Collaborative distribution characterizes leadership practice that is stretched over the work of two or more leaders who work together in time and place and execute the same leadership routine, such as facilitating a faculty meeting. The co-practice in this situation is similar to that in basketball, in which players must interact with one another, passing to team-mates when they stop dribbling and working to set one another up to shoot.

Collective distribution characterizes practice that is stretched over the work of two or more leaders who enact a leadership routine by working separately but interdependently. The interdependencies are akin to those in baseball or cricket, in which players perform at bat alone, but their actions in interaction with that of the pitcher or the bowler collectively produce the practice.

Coordinated distribution refers to leadership routines that involve activities that have to be performed in a particular sequence. The interdependency in this situation is similar to that in a relay race in track; the co-performance of the relay race depends on a particular ordered sequence. (Spillane et al. in Wilkinson, 2007)

Regardless of which model is implemented, research is clear that strong instructional leadership is a key factor in the promoting successful teaching and learning in any learning community.

The concept of distributed leadership acknowledges that expertise is not held by one or two leaders, but is shared or distributed across many (Bennett et al., 2003). Sharing or distributing various expertise shifts the focus of roles, responsibilities and the interrelationships of those involved, and can result in increased engagement of staff members, improved teaching practice being shared and disseminated, and ultimately, in improved student learning. Court (2003) reports key findings from an international study of distributed leadership models that include reduced stress and isolation, enhanced professional learning and resources, better decision-making, more completed projects and developing strong commitments to improving student learning. She identified factors that contributed to successful distributed learning initiatives as

- open and honest communication;

- scheduled time for professional critical reflection and debate;
- negotiated agreements about philosophy and strategies for effective learning;
- ongoing experimentation;
- review and revision;
- commitment to shared responsibility and mutual accountability;
- interpersonal respect and trust.

Distributed leadership provides a conduit through which strong instructional expertise and leadership can be provided in a learning community. Distributed leadership practices implemented in established professional learning communities (PLCs) are best positioned to foster, inspire and disseminate innovative initiatives across a school or school system. This model of leadership allows members of the PLCs to share their expertise collaboratively to implement a clear and compelling local vision of what the community must become in order to help *all* students to learn. A distributed leadership model within an established professional learning community could support critically reflective teaching practice with thoughtful and intentional design of authentic learning opportunities that engage students intellectually and academically and implement assessment practices that improve learning and guide further teaching.

Creating a Culture of Transformative Innovation

Any review of research about effective, sustainable change points to the need for implementing a top-down/bottom-up model of innovation that intimately involves teachers and the work of their classrooms in achieving systemic improvement goals. The National Staff Development Council (NSDC) notes that professional learning that “improves the learning of all students organizes adults into learning communities whose goals are aligned with those of the school and district” (2009). Dede, (2007) acknowledges the challenges to professional development that this work of this nature presents:

... helping teachers, policy makers, and local communities *unlearn* the beliefs, values, assumptions, and cultures underlying schools' standard operating practices, such as forty-five minute class periods that allow insufficient time for all but superficial forms of active learning by students. Altering deeply ingrained and strongly reinforced rituals of schooling takes more than the superficial interchanges typical in "make and take" professional development or school board meetings. Intellectual, emotional, and social support is essential for "unlearning" and for transformational relearning that can lead to deeper behavioral changes to create next generation educational practices. (p. 19)

To assist us in overcoming this challenge, Easton (2008) identifies twelve 'qualities of powerful professional learning' that support the grassroots model of innovation:

1. Powerful professional learning arises from and returns benefits to the real world of teaching and learning.
2. Powerful professional learning requires the collection, analysis and presentation of real data -- from student work and teacher practice.
[This is the kind of data that can help educators make decisions about the kind of learning experiences they need to design, monitor changes happening and make adjustments as needed during implementation in classrooms and schools, provide evidence of improvement and suggest next steps.]
3. Powerful professional learning begins with what will really help young people learn, engages those involved in helping them learn, and has an effect on the classrooms (and schools, districts, even states) where those students and their teachers learn. Educators who engage in powerful professional development first work to understand how a school or district can improve learning for all children, using data as well as their own skills, knowledge, and experiences.
4. Powerful professional learning results in application in the classroom. Throughout the professional learning experience (which may be continuous), the focus remains on what is happening with learners (both student and adult) in the classroom, school, and district.
5. Powerful professional learning experiences may not formally end; they may simply evolve into other powerful forms as participants raise more questions or want to try another strategy. Powerful professional learning usually leads to the desire to make continued improvement. It may even change an institution into a learning community.
6. Powerful professional learning honors the professionalism, expertise, experiences, and skills of staff.

7. Powerful professional learning is content-rich because the content is the school or district itself. . .its staff. . .its learners. This is content that matters to the people engaged in the experience.
8. Powerful professional learning is collaborative or has collaborative aspects to it. Educators learn from each other, enriching their own professional lives and the culture of the school or district. They build a shared vision of a school or district, and – contrasting that with realities – they work on what matters and help each other make changes. They set goals, help each other meet these goals and hold themselves and other accountable.
9. Powerful professional learning establishes a culture of quality. Powerful professional learning encourages discussion about what quality looks like, both in terms of the work educators and their students do.
10. Powerful professional learning results in automatic “buy-in” because it utilizes the talent within. Those who are going to implement change will be more likely to do so if they are involved in the design of the change through powerful professional development.
11. Powerful professional learning slows the pace of schooling, providing time for the inquiry and reflection that promote learning and application. Educators seldom pause in our hectic schedules to make sense of what is going on. They just keep going. Powerful professional learning is a gift to educators who seldom have a chance to reflect on their own teaching and learning.
12. Powerful professional learning designs provide the activities that make professional learning communities (PLCs) more than just a structure.

As these characteristics of powerful professional learning are embedded into the work of professional learning communities (PLCs) we begin to see the benefits of the shared mission, vision, and values, collective inquiry, collaborative teams, action orientation and experimentation, continuous improvement and results orientation that DuFour and Eaker (1998) advocate.

Taking a critically reflective stance in examining powerful professional learning designs in a distributed leadership model reveals an opportunity to ensure that an innovation is much more than a yearly project or a one-off activity, becoming instead an iterative, cyclical part of the systemic culture of learning and improvement. According to Sutch, Rudd, and Facer (2008), this is exactly the form of transformative innovation that is needed in order to “develop new relationships and ways of working, to update approaches, and to harness the collective social

capital and skills of school communities to deliver better teaching and learning.” In doing so, one of the culture shifts that is truly transformative and empowering is that teachers move from simply being practitioners or implementers of curriculum to being innovators and researchers of their own practice. Sutch et al. (2008) comment that the need for this transformative type of innovation is increasingly evident “in order to make the sorts of fundamental changes in educational practice that are needed to respond to social and technological developments” (p. 5), the nature of which have been commented upon earlier in this literature review.

While the importance of the need for educators to ‘develop new professional identities’ to support student centred learning cannot be overemphasized in a discussion of transformation innovation, it is equally important to call attention to the role of the larger system in which teachers do this work. Sutch et al. describe the current reality as one in which teacher innovation tends to be most closely related to changing the activities that go on within an existing structure, instead of “adopting transformational or ‘disruptive’ innovation practices” (p. 6). Teachers have a responsibility to feed their innovative thinking, learning, and professional trajectory back into not only their school culture, but from there into the larger school jurisdiction system, not only to inform but to transform the culture of system improvement, to ensure that leaders, teachers and students are all engaged in learning. In support of this activity by teachers, the Education 2020 Review argues that school jurisdictions have a responsibility as well to “...improve the way that knowledge about personalized learning is captured and transferred within and between schools, to create a system for educational innovation that is better able to meet the challenges ahead” (p. 41), ultimately creating a learning organization in which the core business of all members is to be “engaged in learning”.

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